Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

THE
AMERICAN NATURALIST.

VOL. XXI. JULY, 1887. NO. 7.

THE MILKWEEDS.

BY JOSEPH F. JAMES, M.S.[1]

WHO is there that has not noticed the sticky, whitish juice which exudes on the breaking of the stem of the large and common Milkweed growing so plentifully in waste places and along roadsides? Who has not also noticed that neither horses nor cattle ever touch the plant? While the herbage all around will be closely cropped, often not a blade of grass left more than half an inch high, the Milkweed rears its head aloft in conscious pride of vantage. It well knows, apparently, that it is not acceptable to the animals grazing about it, and finds itself left to perfect its seed in peace and at leisure. It has, perhaps, seemed strange to observe that the plant is so little molested by cattle. It is, to be sure, rank and robust; but that is not a sufficient reason for being rejected. The great Horseweed grows higher and ranker, but is greedily eaten by horses; and many weeds, apparently as little palatable, are devoured. What is there about the Milkweed which gives it an advantage over the other plants of the field? In this, as in other cases, the common name tells the story; but it does not tell why the milky juice, from which it has received its name, is so abundant.

In spite of the platitudes about the peacefulness of nature, as contrasted with the warfare of mankind, no one can wander through woods and fields without coming, in a short time, to the conclusion that the warfare there is even more severe than it is with the human race. He will find that carnivorous animals devour others weaker than themselves; birds feed on grasshoppers and other insects; these again prey on others; and so the warfare continues down to the minute animalcule which can be seen only under the microscope, and which swallows other creatures only a little smaller than itself. Not only so, but he will find the Carnivora disputing with their own kind; wolves fighting with other wolves; birds contending with other birds for the insects they need; and these in their turn fighting their own kind for nearly every mouthful of food. Everywhere he will find war being waged continually; so that he must finally come to the conclusion that nature is far sterner than man in the struggle for the means of living.

---

[1] Professor of Botany and Geology in Miami University.

Perhaps he may think that in the animal world alone this warfare is going on; but if he turns to the vegetable kingdom with the idea that here there can be no such struggle, a short time will convince him of his mistake. He will not, indeed, as a rule, see one plant devouring another in a literal sense; but he will find one sort of tree crowding and pushing another, or overshadowing smaller plants so that they cannot live; he will see them in the fields so close together that he soon concludes they must take more or less moisture and nutriment from each other; he will find the roots so crowded and matted together that the soil is a mass of them; that here one plant has fastened itself on another and is sucking its life away; and he will be forced at last to give a reluctant assent to the assertion that there is warfare among plants as there is among animals, and that the difference is one not of kind, but of degree. This constant, continual, fierce fight is the struggle for existence, in the course of which the fittest will survive. In other words, that plant or animal will be the most likely to live and continue to propagate its species which can best succeed in crowding out some of its competitors, and in taking the nourishment they need to itself.

It is for the purpose of carrying on this continual struggle that many structures have become developed. For instance, the lion has had his strength increased and his retractile claws sharpened by the constant effort he is obliged to make to conquer and carry off his prey. There can be no doubt but that these claws have been acquired in the course of ages, being developed more and more fully as time went on. Neither can there be any doubt but that they are now necessary for his existence. So it is with all other weapons of defence or offence that have been developed by use. Their principal purpose has been to enable their possessor to live, and, as the strongest and the one best provided with good weapons is the one most likely to continue his kind, improvement goes on until a certain degree of perfection is attained, and the animal is fitted to a place which it holds against all competitors.

While adaptations of one kind arise among animals to enable them to compete with each other in this struggle, adaptations of another kind are developed in the plant world. These take the form of hairs on the stems and leaves; stronger modes of growth; climbing propensities; parasitic habits; the development of prickles or thorns; the formation of deleterious juices, unpleasant odors, or aromatic qualities. Others, again, place their chief reliance for continuing their species on the hard shell encasing their nuts or fruits, and, by producing these in enormous numbers, have an excellent chance of perpetuating themselves. All these have, it should be understood, been acquired by plants so they can hold their ground in the battle for life; and, consequently, those species best provided with means to resist the attacks of animals, either by being more unpalatable through disagreeable odors or tastes, or by having tougher or harder shells to the seeds, or by being aromatic, or in some other way, will stand the best chance of living long enough to perfect seed, and thus be the means of continuing their kind.

Each one of the many ways of resisting the attacks of animals has been only gradually acquired. From a small beginning, the importance of which is not at first to be perceived, the features have increased in usefulness and attained perfection only after many severely fought battles with hardy antagonists.

Perhaps one of the most effectual of all the modes of protection acquired by plants is to be found in the presence of a milky or colored juice. This is a character which is shared in common by a great number of species of widely different orders; but there is no species in which the milky juice is more conspicuous than in the Milkweed. While in various species of the Compositæ, such as the Dandelion, the Wild Lettuce, and the

Sow-Thistle, this juice is plainly seen; while in the Buttercup it is acrid, and in the Blood-root it is red, yet in none of these does it seem to serve the purpose so well as in the Milkweeds. It is not, either, confined to any one species, but is characteristic of most members of the order. The species number over thirteen hundred, are widely scattered over the world, and are most diversified in form and habit. Some of them are climbers, some creepers, some herbs of upright growth, some shrubs, and some trees. Two features which are found in many of them are the milky juice and the peculiar flowers. In the common Milkweed of this country (*Asclepias cornuti*) these peculiarities are seen better than in almost any other species. It is also well known that the plant will thrive in nearly every sort of situation; consequently it must possess some quality that gives it a better chance to grow than many other plants. The reason for its dominance is no other than the possession of its sticky, milky juice.

The sap of plants, though varying in different species, serves the same purpose in all. While primarily it is useful in one way, secondarily it may be beneficial in another; yet, not every plant possesses a sap of such service as that of the Milkweed. Serving as a vehicle for the conveyance of nourishment from the roots to the leaves, it carries with it at the same time such disagreeable properties that it becomes a better protection to the plant from enemies than all the thorns, prickles, or hairs that could be provided. In this plant, so copious and so distasteful has the sap become that it serves a most important purpose in its economy. The gradual development of this feature to its present state has been attended by certain changes in the flowers and fruit, which, together, make the family one of great interest; and when it is known that there are a great many plants which possess a milky sap, only not so well developed as in the Milkweeds, it is only necessary to carry the imagination back to a progenitor which possessed the slightest traces of this, and there is sufficient reason to look for its future perfection. In the fierce struggle which goes on constantly among plants, anything which is advantageous in the slightest degree is sure to be preserved; and as it is transmitted to the progeny, and by them sent on downwards, it will improve at every step. If, for example, the plant becomes disagreeable to the animal grazing in its vicinity, it will be left alone just as long as there is anything else to be found. Should there come a favorable season, with an abundant vegetation and good grazing, such plants will then have an excellent chance of perfecting seed. Even during a season when plant-life must struggle for water, and when herbivorous animals greedily devour everything they can find, the milky-juiced plant will succeed better than any other, because it will be the last one to be touched. Thus from generation to generation the development will go on, until it reaches a state which requires no further change, and it then remains quiescent. Having, however, once acquired a feature, it will be a long time, indeed, before it will lose it. In the present instance the flowers seem to have been developing in their way, while the juice pursued its own.

The flowers of the common species are produced in large clusters, are pink in color, and have quite a perceptible odor. They are visited by insects in great numbers, as many as thirty-one different species having been counted; and this fact shows they possess considerable attractive qualities. If we examine an individual flower of a cluster, a peculiarly complicated mechanism will be revealed. The two floral envelopes, calyx and corolla, are folded back or reflexed on the stem. Inside of these is a column made up of five sac-like bodies, each crowned by a horn-like process. These seem to be nectaries, where honey is secreted. Between the nectaries there is found, on examination, a peculiar slit, wider below than above. At the upper end is a hard, thin lamina, or blade, with the sides bent inwards so that the edges are close together. In swollen sacs

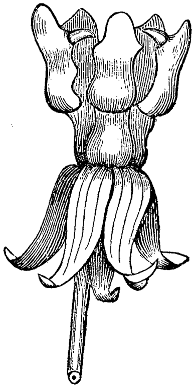
FIG. 1.—Flower of *Asclepias* enlarged.

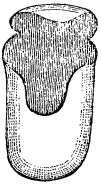
FIG. 2.—Sac in which the pollinium is lodged.

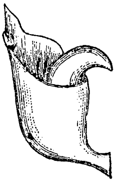
FIG. 3.—Hood, with horn.

on each side of the slit the pollen-grains are found. The peculiar feature of these grains is that they are united into masses or clusters, the individual grains held together by sticky threads, —a feature found in only one other family. The stigma surmounts the two ovaries like a large cap, and is placed immediately in the centre of the column, with the pollen-sacs arranged around the outside. To enable the pollen to reach the stigma the pollinium must be taken out of the sac where it hangs and be inserted into the slit between the nectaries. This can only be effected through the agency of insects, and these perform the service in the following manner:

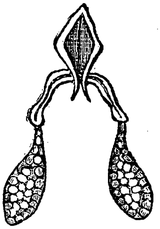

FIG. 4.—Pollen-masses of *Asclepias* hanging by twisted appendages and fastened to the gland above.

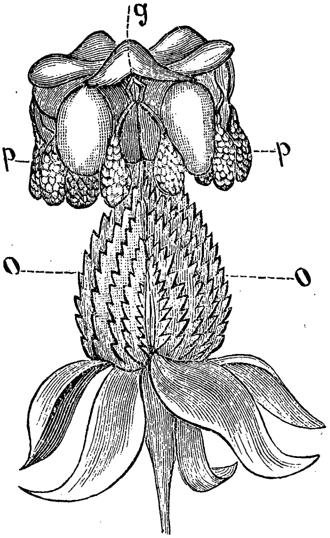

FIG. 5.—Flower with hoods cut away, showing ovaries (*o*), the pollinia (*p*), and the slit or gland (*g*) uniting two of the pollinia.

The visitor, attracted by the odor, alights to suck the nectar secreted in the hoods. In its progress over the blossom some one of the hairs of its legs is sure to slide into the slit between the hoods. Pursuing his way by drawing up his leg, the hair will be guided by two flanges at the sides into the upper and narrower part of the slit, and there become fast. Feeling a detention, the captive will pull to release himself, and, if possessed of sufficient force, will bring out of the sacs at the sides two pear-shaped pollinia, each fastened to the lamina, or gland, by a short appendage (see figure). When they are first withdrawn the pollinia are divergent. In a comparatively short space of time the appendages begin to twist, and then the pollen-masses are brought close together; not, however, before the insect to which they are attached has had time to fly to another flower. On reaching this new flower the hair bearing the pollen will be guided into the slit, and, too large to be drawn through, will be detached, and so left in the exact position to send the pollen-tubes into the stigma.

Insects visiting the flowers often have cause to rue the visit. Honey-bees have often been found dead, with many pairs of glands or pollen-masses attached to them; for, visiting the flowers and extracting numbers of the masses, they become entangled, and finally perish of starvation. One entomologist, having found a beetle with many pairs of stalks and pollinia upon the hairs of its tarsi, sent a drawing of it to a scientific journal, and referred to it as possessing peculiar appendages, the like of which he had not before seen, and which he supposed to belong really to the hairs to which they adhered. But it was soon pointed out that, instead of natural appendages, they were those acquired in peregrinations over clusters of Milkweed blossoms.

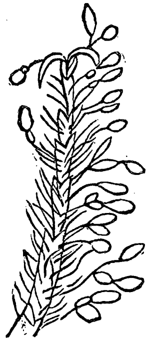

FIG 6.—Leg of beetle, with pollinia attached to the hairs.

Notwithstanding the numbers of insects frequenting the flowers, it is noticeable that only a few of them produce seed; for the pollen-masses *must* be removed from the sacs and *must* be inserted into the slits before the stigma can be fertilized. Sometimes, it is true, the grains, while yet in the sacs, send tubes into the stigmas; but these tubes are inoperative, and do not enable the flower to set a pod. It is quite rare to find more than two pods produced out of a bunch of, perhaps, fifty flowers; and often there will be only one or two pods on the whole plant. But what the plant lacks in the number of pods it makes up in the number of seeds found in each one. These seeds are packed so closely and tightly together that a single pod contains an immense number. They are provided, too, with such an admirable appendage for being wafted through the air, and this serves its purpose so effectually, that even a few pods are sufficient to stock a large tract of country.

The peculiar arrangement of the pollen-grains in masses is something which is found in but one other family. This is the Orchid family. In this order the peculiarity has been more fully developed than in the first one, and the differentiation is greater. Ordinarily in the Orchids the caudicle, or stem, contracts and bends the pollinium forward; in the Asclepiads the appendage twists in drying, and the two pollinia are then brought close together. In both cases the pollen-grains are only then in a position to reach the stigma. Darwin has demonstrated that the contraction of the caudicle of the Orchid pollinium is necessary to prevent its being put back into a cell similar to the one from which it was taken. In the Asclepiads the twisting of the appendage brings the two pendent pollen-masses together, and enables them to slip into the slit between the hoods, and be thus in a position to reach the stigma.

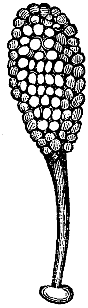

FIG. 7.—Pollinium of *Orchis*.

The appendage to the seed of the Milkweed is of the same character as that found in the Dandelion, the Thistle, and many other plants. In all it serves the same end. But in some species of the family the coma has the peculiarity of expanding very rapidly on exposure to the air. In one of these (*Gonolobus obliquus*) it is recorded by Mr. Meehan that the expansion of the coma is so rapid as to be compared to a stroke of lightning. He says it is followed by the eye with difficulty. While one instant it is enclosed in the capsule closely packed away, as soon as it is exposed the hairs of the coma fly round and form a perfect hemisphere. This is a necessity, because if it did not so occur, the seeds, being heavy, would fall to the ground close to the parent plant, and the purpose of the development of the feathery appendage would be defeated; but, drying so rapidly, they are in a condition to be carried by the lightest wind to great distances.

While in the common Milkweed the milky juice of the stem is so abundantly developed, it is a little remarkable that in another species (the Pleurisy Root) it is entirely wanting. The flowers are similar, and the sap is so acrid as to cause the plant to be rejected by all animals. It grows in very poor soil, and has but few plants to contend with; so that the acridity serves to protect it in much the same way as if it had a milky juice.

The sixty or more species of Asclepias are, with two exceptions, confined to the American continent, and the amount of milky juice varies in the different species. The acridity of those species which have no milky juice is a sufficient protection, however, from the attacks of herbivorous animals.

Other genera of the order present, in their turn, various features of interest. *Stapelia* is a genus of about one hundred species, all of them found in the Cape of Good Hope region. They are peculiar in having thick, fleshy stems, generally with small scales in place of leaves borne on the angles of the stems. The flowers are mainly star-shaped, starting out at various points on the stem, and are remarkable for their disagreeable, carrion-like odor. This is so marked in certain species that it attracts large numbers of flies. These sometimes lay their eggs in the flowers, but the progeny, when hatched, die for want of food. The main object of the odor of the flower is to attract insects for the purpose of fertilizing it by the transfer of pollen from one plant to another. About the centre of the flower are certain black spots, which are peculiarly attractive to insects. In one species (*S. asterias*) flies have been observed to feed greedily about these spots, and it is found that the fly's tongue often gets caught in a trap situated hereabouts. When thus caught it struggles violently to escape, and, if successful, goes away with a pair of pollinia attached to its tongue, drawn from their enclosing sacs. The apparatus which catches the tongue is a veritable spring-trap, closing with a snap on the intrusion of any disturbing object. The insect, laden with the pair of pollen-masses, flies to another flower, and there places them in a position where the pollen-tubes can penetrate the stigma. Here, then, there are three interesting features to be noted,—first, the thick, succulent, leafless stems, which enable the plants to exist in dry, sandy soil, and, at the same time, furnish no inducement to any stray animal to feed upon; second, the carrion-scented flowers, which attract flies, necessary for the fertilization of the stigma; and, third, a veritable spring-trap, which catches the tongue of the little carrier, so that it flies away with the pollinia to another flower, and effects cross-fertilization.

The succulent stem may be regarded as developed because of the necessity to retain a supply of moisture in the dry, arid regions, whither the plants have probably been driven from an inability to cope with more vigorous forms of vegetation. The scent of the flowers has been acquired to enable insects to detect the presence of the plant at a distance, while the spring-trap was a necessary contrivance to certainly secure the transferrence of the pollen from one plant to another.

Besides the genera *Asclepias* and *Stapelia*, there are others which possess points of interest, or are valuable in a commercial sense. The species of the genus *Hoya* have climbing stems, thick, succulent leaves, and clusters of waxy flowers. Hence the common name of wax-plant. Various species are cultivated, and are great favorites because of their fragrance and beauty. It is stated that the young leaves are used by the natives of Ceylon in their curries; and one curious feature of the plant is that the flowers come from the same bud year after year.

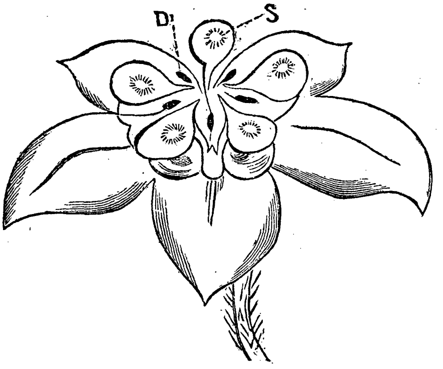

FIG. 8.—Flower of *Hoya*. S, stigmas; D, disks of pollinia.

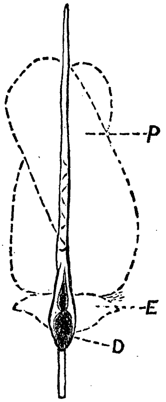

FIG. 9.—Disk and pollinia P, pollinia; E, elastic appendage; D, disk.

The fertilization of *Hoya globulosa* possesses points of interest, the mechanism being much the same as in Asclepias. It has been described in the *Gardeners' Chronicle* for April 29, 1882, by Mr. W. G. Smith, as follows: The flowers are regular, grow in clusters, and are very fragrant. The pollen-grains are united in clusters and enclosed in pouches, five in number. The glutinous, dark-colored disks of the pollinia are the only parts of the stamens visible in an open flower. If an insect, attracted by the fragrance, alights on a flower, it almost invariably happens that one foot slips and is caught by one of the sticky disks. Sometimes four feet are entangled, and then ensues a struggle to escape. If strong enough, the fly tears itself away, but in the effort takes the pollinia attached to its feet along with it. "The basal appendages of each pair of pollen-masses," says Mr. Smith, "are elastic, and when in the pouch they are like an extended spring, but the instant the masses are drawn out by the insect's foot the spring closes, the two pollen-masses quickly cross each other and hold tightly on to the insect's little claws." The stigmas of the flower are exposed in the centre of the parts forming the apex of stamens and pistils, and these are not ripe at the same time as the pollen. It is therefore necessary for the pollinia to be withdrawn from the pouches and conveyed by the insect to another flower in which the stigmas are ripe before fertilization can take place.

Other species of the family are noted for their medicinal properties. For example, one known as *Tylophora asthmatica*, or Indian Ipecacuanha, is largely used in cases of dysentery. Others are valued for their fibre. One of these is *Calotropidis* (*Asclepias*) *gigantea*. This is spun into the finest thread for sewing or weaving. Handkerchiefs made from it were shown in one of the Paris exhibitions. A species in our own country, very common in wet or damp places (*Asclepias incarnata*), produces a long, tough fibre which could be used for many purposes. Another species (*Marsdenia tenacissima*) produces fibre so strong that the natives of some parts of India use it for bowstrings. The stems are dried in the sun, and the milky juice which exudes hardens into a substance like india-rubber; and there are other species in which this juice could be used for many of the purposes to which caoutchouc is now applied.

It is thus seen that the family of Milkweeds is useful practically, as well as interesting botanically. We use the sap in our way as the plant uses it in its own. The same tough fibre which makes the plant disagreeable to animals the human race finds useful to itself. The same sweet-scented flowers which attract swarms of insects delight us in our greenhouses; and the same curious forms of stems adapted to a plant's existence in dry and arid regions form curious features in the homes of civilized man.